REMARKS

The Applicant thanks the Examiner for the thorough consideration given the present application. Claims 2, 5, and 10 are cancelled herein without prejudice to or disclaimer of the subject matter set forth therein. Claims 1, 3, 4, 6-9, 11, and 12 are pending. Claims 1, 3, 4, 6-9, 11, and 12 are amended. Claim 1 is independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

Drawings

It is gratefully appreciated that the Examiner has accepted the drawings.

Claim for Priority

It is gratefully appreciated that the Examiner has acknowledged the Applicant's claim for foreign priority.

Information Disclosure Citation / Objection to the Specification

The Examiner has objected to the specification alleging that the Page 26, line 28 discloses "BE-A-8383796", yet it should be "FR 838796". It appears that the Form PTO SB/08 submitted with the IDS filed on December 3, 2004, incorrectly read "FR 838796" instead of the correct citation "BE-A-838796". A copy of BE-A-838796 was included with the IDS filed December 3, 2004, and thus was fully disclosed by the Applicant.

Meanwhile, the Applicant thanks the Examiner for considering the references, including BE-A-838796 that were supplied with the Information Disclosure Statement filed December 3, 2004, and for providing the Applicants with an initialed copy of the PTO form filed therewith.

To address the Examiner's objection to the specification, a corrected Form PTO SB/08 and another copy of the previously submitted BE-A-838796 document are enclosed with this Amendment for the convenience of the Examiner. It is respectfully requested that the Examiner return as initialed copy of this latest Form PTO SB/08 in the next official communication.

Rejection Under 35 U.S.C. § 112, second paragraph

Claims 1-12 stand rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed.

The Examiner has set forth certain instances wherein the claim language is not clearly understood.

In order to overcome this rejection, the Applicant has amended claims 1, 3, 4, 6-9, 11, and 12 to address the issue pointed out by the Examiner. The Applicant respectfully submits that the claims, as amended, particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Rejections Under 35 U.S.C. §103(a)

Claims 1-12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over the English Abstract of JP 404280920 in view of U.S. 5,146,759.

This rejection is respectfully traversed.

Amendments to Independent Claim 1

While not conceding the appropriateness of the Examiner's rejection, but merely to advance prosecution of the instant application, independent claim 1 is amended herein to recite a combination of steps directed to a method of patenting at least one steel wire, including *inter alia*

- heating said at least one steel wire to an austenitisation temperature of steel,

- ejecting pressurised gas bubbles into a mass of cooling liquid, in a manner which is guided upwards, and entraining said cooling liquid by said bubbles in a form of at least one cooling liquid curtain with an upward turbulent flow,

- abruptly cooling said at least one wire in said cooling liquid which has reached said austenitisation temperature, by passing said at least one steel wire through said at least one cooling liquid curtain,

the at least one cooling liquid curtain exhibiting said upward turbulent flow being oriented substantially transversely to said at least one moving wire, while obtaining a cooling temperature situated below the austenitisation temperature and above a martensitic transformation temperature,

- adjusting a successive number of the cooling liquid curtains, the number being determined so as to obtain, by the said cooling said wire in said cooling liquid, a perlitic transformation temperature to be maintained during a step of maintaining said at least one wire in an isothermal state, as the cooling temperature; and

- performing the step of maintaining said at least one steel wire in the isothermal state at the perlitic transformation temperature until completion of a perlitic transformation,

wherein the step of maintaining said at least one steel wire in the isothermal state is performed directly following the step of cooling in the cooling liquid.

As the Examiner will note, independent claim 1 has been amended to include the subject matter previously set forth in now-cancelled claim 5.

A. In contrast to the present invention, as can be seen in the English abstract of the JP 4280920, the steel wire rod is merely submitted to a wire drawing. The steel wire rod is effectively submitted to the steps of heating to the austenitisation temperature, rapid cooling and isothermal maintenance.

However, there are at least three (3) patentable differences between the method according to JP '920 and the method according to the present invention.

1°) The step of rapid cooling in the JP920 is obtained in a cooling device 2 which is only schematically illustrated and which is for example a water spray nozzle.

Such a cooling is thus obtained by surrounding the wire by a water mist. Thus the present invention provides a suspension of fine droplets in an air jet. When the suspension of fine droplets arrive near the wire to cool, these droplets are transformed from liquid into vapour. Consequently a vapour film forms an "insulation" between the liquid and the surface of the wire.

The cooling rate is therefore diminished. Effectively the most droplets of water at liquid stage are transformed into vapour, and only a few penetrate through the vapour film while striking the wire. A "breaking" of the vapour layer is prevented.

The system according to the present invention allows a breaking of the vapour film and consequently a cooling in a cooling liquid curtain. The principle of operation is to make fluid circulate by bubbling through air. Air is introduced under pressure into the water and forms an emulsion.

The bubbles of air exert a force into the fluid which is thus forced to move upwards and to form upward flowing turbulent liquid curtain.

Thus, the air bubbles carry a quantity of liquid water that is projected onto the wire. Each time air bubbles are reaching the wire surface, the vapour film is broken because the air bubble is "licking" the wire and the entrained liquid immediately makes the surface of the wire wet through projection.

The disappearance of the vapour film, the improvement of the unsticking of the air bubbles, the projection of water by means of said bubbles and the so created turbulence,

highly favour the thermal exchange.

In case of upward flowing cooling liquid curtains of water, the whole surface of the wire is permanently surrounded by a water layer because the upwardly rising curtain falls thereafter on the wire.

Further, we draw the Examiner's attention on the fact that, in the present invention, the water is not under pressure and no pump is necessary to pressurize the water.

2°) In JP '920, the temperature obtained by the rapid cooling must be a working temperature between Ael point and 500°C, which is not below the perlite transformation initiating temperature and not falling below the perlite transformation as said in the Office Action. This cooling is not so abrupt as in the present invention which contrarily to the teaching of JP920 needs a cooling up to the perlitic transformation temperature and consequently it is understandable that a less efficacious cooling may be accepted in this case.

3°) In JP '920, after the rapid cooling, the steel wire rod is merely submitted to a plastic working by means of a roller die 3 at the above mentioned working temperature. Only thereafter the plastically worked wire rod is subjected to an isothermal holding in order to undergo a perlite transformation. Consequently the isothermal maintenance in the JP '920 does not take place directly after the quenching.

On the other hand, according to the present invention, the isothermal maintenance is carried out directly after the quenching. As the number of successive liquid curtains is

adjustable, the temperature maintaining device is conceived movable.

B. U.S. Patent 5,146,759 merely discloses a method for a rapid direct cooling of a hot-rolled wire rod. The cooling is obtained by means of an air-water mist 18 (see also claim 1) sprayed partially from the bottom. This system is unable to create upward flowing cooling liquid curtains of the present invention. Therefore, the problems of cooling efficacy as disclosed in JP '920 remain the same.

We draw the Examiner's attention to the fact that U.S. Patent '759 merely teaches a suspension of water droplets in air (a mist), and not an emulsion of air bubbles in a liquid water medium as in the present invention.

In addition, there is no particular explanation in U.S. '759 about an isothermal maintenance of a wire having been subjected to a perlitic transformation directly after this transformation.

Consequently even if the skilled person incorporates the teaching of the U.S. '759 into the method disclosed in the JP '920 he would not obtain a method as claimed in the present invention.

At least for the reasons explained above, the Applicant respectfully submits that the combination of elements as set forth in independent claim 1 is not disclosed or made obvious by the prior art of record, including JP 404280920 in view of U.S. 5,146,759.

Therefore, independent claim 1 is in condition for allowance.

Dependent Claims

The Examiner will note that dependent claims 3, 4, 6-9, 11, and 12 have been amended, and dependent claims 2, 5, and 10 have been cancelled.

All dependent claims are in condition for allowance due to their dependency from allowable independent claims, or due to the additional novel features set forth therein.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. §103(a) are respectfully requested.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 208-4030(direct line).

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

Respectfully submitted,
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JMS:CTT:ktp

Attachments: Corrected Form PTO SB/08
Duplicate copy of BE 838,796 filed submitted on December 3, 2004